

**REMARKS**

An Excess Claim Fee Payment Letter is attached hereto to cover the cost of four (4) excess total claims.

Claims 19-52 and 119-135 are all the claims presently pending in the application. Claims 19-20 and 128-131 have been amended to more particularly define the claimed invention. Claims 132-135 have been added to claim additional features of the claimed invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 19-52 and 119-131 stand rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Sayyah, et al. (Published in *Journal of Crystal Growth* 77 (1986) pp 424-429) in view of the alleged admitted prior art (APA). Claims 19-52 and 119-131 stand rejected under the doctrine of obviousness-type double patenting over claims 1-24 of U. S. Patent No. 6,362,017 (hereinafter, the '017 patent) in view of the alleged APA.

These rejections are respectfully traversed in the following discussion.

**I. EXEMPLARY ASPECTS OF THE CLAIMED INVENTION**

**Applicant notes that the features of the exemplary aspects of the claimed invention which are described in this Amendment pertain only to the claimed invention of the present Application. These features are not necessarily included in other aspects of the invention and, therefore, the description of such features in this Amendment should in no way be considered as limiting other aspects of the invention which may be the subject of other patents or patent applications.**

An exemplary aspect of the claimed invention (e.g., as recited in claim 19) is directed to a method for producing a gallium nitride group compound semiconductor by using an organometallic compound vapor phase epitaxy. The inventive method includes setting a mixing ratio of a silicon-containing gas to at least one other raw material gas at a desired value in a range over which a conductivity of the gallium nitride group compound

semiconductor increases substantially proportionally with the mixing ratio so as to obtain a desired conductivity (1/resistivity) of the gallium nitride group compound semiconductor, forming a first n-conduction type of gallium nitride group compound semiconductor layer with a high electron concentration by feeding the silicon-containing gas and the at least one other raw material gas at the mixing ratio, and forming a second n-conduction type of gallium nitride group compound semiconductor layer with a low electron concentration and having a resistivity which is greater than a resistivity of the first n-conduction type of gallium nitride group compound semiconductor layer, without feeding the silicon-containing gas.

In another exemplary aspect (e.g., as recited in claim 20), the inventive method includes setting a mixing ratio of a silicon-containing gas to at least one other raw material gas at a desired value in a range over which a carrier concentration of the gallium nitride group compound semiconductor increases substantially proportionally with the mixing ratio so as to obtain a desired carrier concentration of the gallium nitride group compound semiconductor, forming a first n-conduction type of gallium nitride group compound semiconductor layer with a high electron concentration by feeding the silicon-containing gas and the at least one other raw material gas at the mixing ratio, and forming a second n-conduction type of gallium nitride group compound semiconductor layer having a low electron concentration and a resistivity which is greater than a resistivity of the first n-conduction type of gallium nitride group compound semiconductor layer, without feeding the silicon-containing gas.

Importantly, these exemplary aspects of the claimed invention (e.g., the aspects of claims 19 and 20) include etching the second n-conduction type of gallium nitride group compound semiconductor layer to expose a surface of the first n-conduction type of gallium nitride group compound semiconductor layer, an n-electrode being formed on the exposed surface of the first n-conduction type of gallium nitride group compound semiconductor layer (Application at page 16, line 13-page 17, line 21; Figures 1-7).

Conventional methods of forming a gallium nitride group compound semiconductor can form a light emitting diode having a relatively low luminous intensity.

The claimed method, on the other hand, etches the second n-conduction type of gallium nitride group compound semiconductor layer to expose a surface of the first n-conduction type of gallium nitride group compound semiconductor layer, an n-electrode

being formed on the exposed surface of the first n-conduction type of gallium nitride group compound semiconductor layer. This helps to allow the present invention to form a gallium nitride group compound semiconductor can form a light emitting diode having a high luminous intensity (Application at page 17, line 25-page 18, line 6). .

### **III. SAYYAH AND THE ALLEGED ADMITTED PRIOR ART (APA)**

The Examiner alleges that Sayyah would have been combined with the alleged APA to form the invention of claims 19-52 and 119-131. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Applicant respectfully submits that these references would not have been combined as alleged by the Examiner. Indeed, Sayyah merely discloses a study which concludes that Si doping cannot be used change AlGa<sub>N</sub> from semi-insulating to conducting (Sayyah at page 164, first paragraph), whereas the alleged APA merely refers to the electric properties of GaN. Thus, the APA is unrelated to Sayyah, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In addition, the Examiner has never identified any motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner merely states that the alleged APA "teaches forming an i-GaN layer" and that "[i]t would have been obvious to form i-GaN layer to improve light efficiency" (Office Action at page 4). However, the claimed invention of the exemplary aspects of claims 19 and 20 does not necessarily include an i-GaN layer and therefore, it is clearly unreasonable for the Examiner to attempt to rely on the alleged teaching of an i-GaN layer as somehow providing a motivation for combining the alleged APA with Sayyah to form the claimed invention.

In fact, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Sayyah nor the alleged Admitted Prior Art, nor any combination thereof teaches or suggests *"etching said second n-conduction type of gallium nitride group compound semiconductor layer to expose a surface of said first n-conduction type of gallium*

*nitride group compound semiconductor layer, an n-electrode being formed on said exposed surface of said first n-conduction type of gallium nitride group compound semiconductor layer", as recited, for example, in claims 19-20. As noted above, this helps to allow the present invention to form a gallium nitride group compound semiconductor can form a light emitting diode having a high luminous intensity (Application at page 17, line 25-page 18, line 6).*

Clearly, these novel features are not taught or suggested by the cited references. Indeed, Applicant respectfully submits that Sayyah does not teach or suggest forming a high electron concentration n-GaN layer, forming a low electron concentration n-GaN layer on the high electron concentration n-GaN layer, etching the low electron concentration n-GaN layer to expose the surface of the high electron concentration n-GaN layer, and forming an n-electrode on the expose surface.

In particular, nowhere does Sayyah teach or suggest forming a light-emitting device by using a GaN of n-type conductivity which includes layers (e.g., two layers) each having different electron concentration. In an exemplary aspect of the claimed invention, the n-type conductivity layer may include a two-layer structure. Further, the high electron concentration n-GaN layer which may form the n-electrode may be doped with silicon so that the conductivity and electron concentration of the n-GaN layer are proportional to those of silicon.

Likewise these features are not taught or suggested by the alleged APA. Indeed, as noted above, the alleged APA merely refers to the electric properties of GaN. The alleged APA may discuss an n-layer of GaN, but nowhere does the alleged APA teach or suggest forming a second n-conduction type of gallium nitride group compound semiconductor layer, let alone etching such a layer to expose a surface of a first n-conduction type of gallium nitride group compound semiconductor layer. In fact, the alleged APA expressly teaches that an insulating GaN layer (i.e., not a second n-type GaN layer) is formed on an n-type GaN layer.

Further, the alleged APA certainly does not teach or suggest an n-electrode, let alone an n-electrode being formed on an exposed surface of a first n-conduction type of gallium nitride group compound semiconductor layer. Thus, the alleged APA clearly does not make up for the deficiencies of Sayyah.

Therefore, Applicant submits that these references would not have been combined and even if combined, the alleged combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

### III. THE OBVIOUSNESS-TYPE DOUBLE PATENTING REJECTION

The Examiner alleges that claims 1-24 of the '017 patent would have been combined with the alleged APA to form the invention of claims 19-52 and 119-131. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

First, Applicant would respectfully remind the Examiner that the Examiner can rely only on the teachings of claims 1-24 of the '017 patent in making this double-patenting rejection. That is, the Examiner cannot rely upon any part of the disclosure of the '017 patent to support her position.

Further, Applicant respectfully submits that these references would not have been combined as alleged by the Examiner. Indeed, claims 1-24 of the '017 patent disclose a method for producing a GaN compound semiconductor in which a mixing ratio is controlled to provide a resistivity in a specified range. Thus, the alleged APA is unrelated to the claims 1-24 of the '017 patent and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In addition, the Examiner has never identified any motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner merely states that the alleged APA "teaches forming an i-GaN layer" and that "[i]t would have been obvious to form I-GaN layer to improve light efficiency" (Office Action at page 5). However, the claimed invention of the exemplary aspects of claims 19 and 20 does not necessarily include an i-GaN layer and therefore, it is clearly unreasonable for the Examiner to attempt to rely on the alleged teaching of an i-GaN layer as somehow providing a motivation for combining the alleged APA with claims 1-24 of the '017 patent to form the claimed invention.

Moreover, neither claims 1-24 of the '017 patent, nor the alleged Admitted Prior Art, nor any combination thereof teaches or suggests "*etching said second n-conduction type of*

*gallium nitride group compound semiconductor layer to expose a surface of said first n-conduction type of gallium nitride group compound semiconductor layer, an n-electrode being formed on said exposed surface of said first n-conduction type of gallium nitride group compound semiconductor layer", as recited, for example, in claims 19-20.*

Clearly, these novel features are not taught or suggested by claims 1-24 of the '017 patent. Indeed, Applicant would point out that nowhere do claims 1-24 teach or suggest etching a second n-conduction type of gallium nitride group compound semiconductor layer to expose a surface of the first n-conduction type of gallium nitride group compound semiconductor layer. Moreover, nowhere do claims 1-24 teach or suggest an n-electrode, let alone an n-electrode formed on the exposed surface of the first n-conduction type of gallium nitride group compound semiconductor layer.

Therefore, the Examiner's position is completely unreasonable.

Therefore, Applicant submits that these references would not have been combined and even if combined, the alleged combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

#### **IV. FORMAL MATTERS AND CONCLUSION**

In view of the foregoing, Applicant submits that claims 19-52 and 119-135 all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

Serial No. 10/052,347  
Docket No. F01-257-UScont

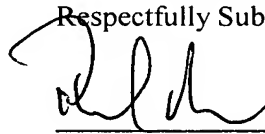
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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date:

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Phillip E. Miller  
Reg. No. 46,060

**McGinn & Gibb, PLLC**  
8321 Old Courthouse Road, Suite 200  
Vienna, VA 22182-3817  
(703) 761-4100  
**Customer No. 21254**